

42. At the beginning of the exercises and problems section in the textbook, we are told to assume $v_{\text{sound}} = 343 \text{ m/s}$ unless told otherwise. The second harmonic of pipe A is found from Eq. 17–39 with $n = 2$ and $L = L_A$, and the third harmonic of pipe B is found from Eq. 17–41 with $n = 3$ and $L = L_B$. Since these frequencies are equal, we have

$$\frac{2v_{\text{sound}}}{2L_A} = \frac{3v_{\text{sound}}}{4L_B} \Rightarrow L_B = \frac{3}{4}L_A.$$

(a) Since the fundamental frequency for pipe A is 300 Hz, we immediately know that the second harmonic has $f = 2(300 \text{ Hz}) = 600 \text{ Hz}$. Using this, Eq. 17–39 gives

$$L_A = (2)(343 \text{ m/s})/2(600 \text{ s}^{-1}) = 0.572 \text{ m}.$$

(b) The length of pipe B is $L_B = \frac{3}{4}L_A = 0.429 \text{ m}$.